USDA/NASA Workshop
Breakout Synthesis Report

Focus Area: **Carbon Management**

Synthesis Team:

Number of Breakout Groups: 1

Total Participants:

Part 1 – Requirements Definition
Part 2 – Research & Data Relevance
Part 3 – Gap Identification
Part 4 – Collaborative Opportunities

Part 1 – Requirements Definition: What are USDA's policy and program needs that might be fulfilled with remotely sensed information?

1. Acquire high spatial and temporal resolution imagery at the local level for:
    - Quantifying plant height, canopy structure, and biomass
    - Monitoring natural and human-induced disturbances
2. Link remotely sensed data to ground based data measurements and scale to local, regional, continental.
3. Monitor and measure management practice, crop type, land cover/land use, crop yields, soil texture and depth (from soil inventories), for use as inputs to models for estimation of carbon stocks and fluxes.
4. Improve monitoring and verification of carbon stocks and GHGs fluxes for:
    - Quantification and differentiation between carbon pools (inorganic, organic) at depth
    - Characterizing atmospheric concentrations of GHGs for inverse models
5. Geospatial information is needed for program managers involved in the design, implementation, and assessment of conservation programs at multiple time scales.

Part 2 – Research & Data Relevance: What is the state-of-the-research (USDA and NASA current research and capabilities) pertaining to these needs?

1. Acquire high spatial and temporal resolution imagery at the local level.

- Regional and continental scale capabilities are pretty good.
- RADAR data in use but not widespread

- Good correlation of vegetation cover/type

2. Link remotely sensed data to ground based data measurements and scale to local, regional, continental.

- Small-scale research underway
- USDA providing GPS locations for NRI and FIA plots
- NASA integration of satellite data
- On-going studies
- Spatial statistics, analysis of quantitative modeling (e.g., nested RS data products)

3. Monitor and measure parameters for use as inputs to models for estimation of carbon stocks and fluxes.

- Have crop yield data and NDVI (good at regional and continental levels)
- Missing cropping practice data – e.g. tillage type

4. Improve monitoring and verification of carbon stocks and GHGs fluxes.

- Using survey data & models to integrate RS & inventory data

5. Geospatial information is needed for conservation programs at multiple time scales.

- MODIS and AVHRR provide repeatability at med to low resolution for land cover and change products, phenological changes over a growing season, disturbance frequency, and identification of areas of interest
- Landsat has the needed resolution but does not have the repeatability for disturbance frequency
- Shuttle Radar Topography Mission data sets provide information on topography across the nation
- Point models used to predict surface processes
- Use of SAR techniques for classifying vegetation in 2- (texture) and 3-D (polarimetry)

Part 3 – Gap Identification: What are the gaps in existing knowledge and research?

1. Acquire high spatial and temporal resolution imagery at the local level

- We cannot be quantitative, especially in high biomass systems
- Better temporal and spatial resolution
- Need 3D biomass profiling linking data sets from active and passive sensors.

2. *Link remotely sensed data to ground based data measurements and scale to local, regional, continental.*

- Better models, better ways of handling large volume (e.g. standards)

- Restricted access to GPS locations for ground data
- Timing of surveys
- Internal USDA coordination on definitions, etc.
- Lack of ecosystem process models
- Aggregating spatially explicit data
- Fundamental pieces not in place

3. *Monitor and measure parameters for use as inputs to models for estimation of carbon stocks and fluxes.*

- Missing data on management practice, plant type,
- Granularity of cropping practice, plant type, rotations, etc.
- Landscape structure data on a continuous basis
- Measurements of concentration of GHGs at the local scale

4. Improve monitoring and verification of carbon stocks and GHGs fluxes.

- Measurements of concentrations of GHGs at the local scale

5. Geospatial information is needed for conservation programs at multiple time scales.

- No systematic approach for combining field data, sensor, and models – developing data assimilation with models
- Scaling up local data for meaningful regional, continental estimates
- Spatial and temporal variability of carbon sources and sinks
- A better understanding of how weather/climate impacts the success of conservation programs and how such information can assist in the design on short time frames.
- Higher spatial resolution imagery and hyperspectral imagery for better land cover classifications

PART 4 – Collaborative Opportunities: What are the opportunities for collaborative/cooperative R&D efforts between USDA and NASA to develop products and solutions that serve decision makers?

1. Acquire high spatial and temporal resolution imagery at the local level

- Linking FS inventory data to new spaceborne systems
- Linking NRI & other USDA collected data
- Collaborating on developing analytical approaches
- Use airborne sensors in the near term to conduct pilot studies. (e.g., LVIS, AVIRIS)
- VCL vegetation canopy LIDAR – possible in < 5-years

2. *Link remotely sensed data to ground based data measurements and scale to local, regional, continental.*

- Take inventory & flux data & scale up using high resolution RS data for

a large area
- Joint research announcement NRI, FIA, NASS
- Joint working groups – better intra-agency coordination
- Dependant on B2 progress

3. *Monitor and measure parameters for use as inputs to models for estimation of carbon stocks and fluxes.*
- Project/pilots to assess proof of concept in application remote sensing data to identify management practices
- Redo portions of 70's & 80's LACIE and AgRISTARS projects to assess crop productivity.
- Create web-based tools and decision support systems

4. Improve monitoring and verification of carbon stocks and GHGs fluxes.
- Developing spatially continuous estimates of soil carbon stocks through integrating soil survey data with high vertical resolution DEMs

5. Geospatial information is needed for conservation programs at multiple time scales.
- EQIP innovation grants
- Sensor development projects
- Collaboration on assessments to benchmark new technologies
- Leverage existing projects on soil/above ground carbon to validate models derived from remote sensing data
- Multi-scale analysis pooling together unique assets and information from USDA and NASA
- Comparing methodologies for measuring and monitoring carbon cycling on agricultural cropland, rangeland, and forestland to ensure complementarily
- Energy title of 2002 farm bill calls for research on sequestration etc.
- State-level pilot programs
- USDA/NASA to design a pilot program to identify potential problems in collaboration